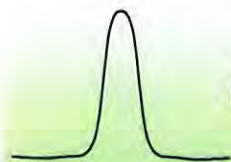


User's Manual

Femtolite ULTRA Laser System

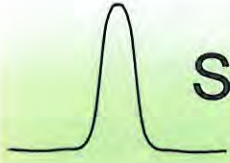
- Type A (780 nm single wavelength output)
Model: AX-20
- Type B (1560 nm single wavelength output)
Model: BX-60
- Type C (780 nm / 1560 nm dual wavelength simultaneous, coaxial output)
Model: CX-20
- Type F (800 nm single wavelength output)
Model: FX-10
- Type H (800 nm / 1600 nm dual wavelength simultaneous, coaxial output)
Model: HX-10

- Carefully read this user's manual before using the laser system.
- Keep this user's manual in a safe and easy accessible place for reference.
- Please include this user's manual with the system when selling or transferring it.



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Safety Precautions (Always Read Before Use)

The purpose of these safety precautions is to prevent damage and injury that can result from incorrect use of the laser system. Please read and always follow the safety precautions carefully.

■ About the meaning of " Danger, " Warning," and " Caution"



Danger

This symbol indicates the possibility of danger resulting in immediate death or serious injury from incorrect use of the laser system.



Warning

This symbol indicates the possibility of death or serious injury from incorrect use of the laser system.



Caution

This symbol indicates the possibility that bodily injury or physical damage can occur from incorrect use of the laser system.

- About the meaning of the symbols



This symbol indicates prohibited actions



This symbol indicates actions you should perform

"⚠ Danger"

Do not look directly at the laser emission beam (laser light) or at the dispersed light, and do not look into the laser



There is a risk of eye damage or loss of eyesight.

Do not try to disassemble or repair the laser head by yourself



There is a risk of eye damage or loss of eyesight.

"⚠ Warning"

Do not irradiate flammable materials (black cloth or paper, materials with excellent light absorption) with the laser emission beam (laser light)



There is a risk of fire.

Do not try to disassemble or repair the laser controller by yourself



There is a risk of burns and electric shock.

Do not block fan guard or exhaust holes on the controller



There is a risk of fire.

Do not get the laser head or controller wet



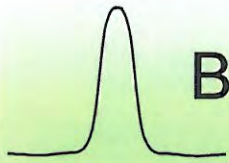
There is a risk of electric shock and fire.

"⚠ Caution"

Do not touch the beam



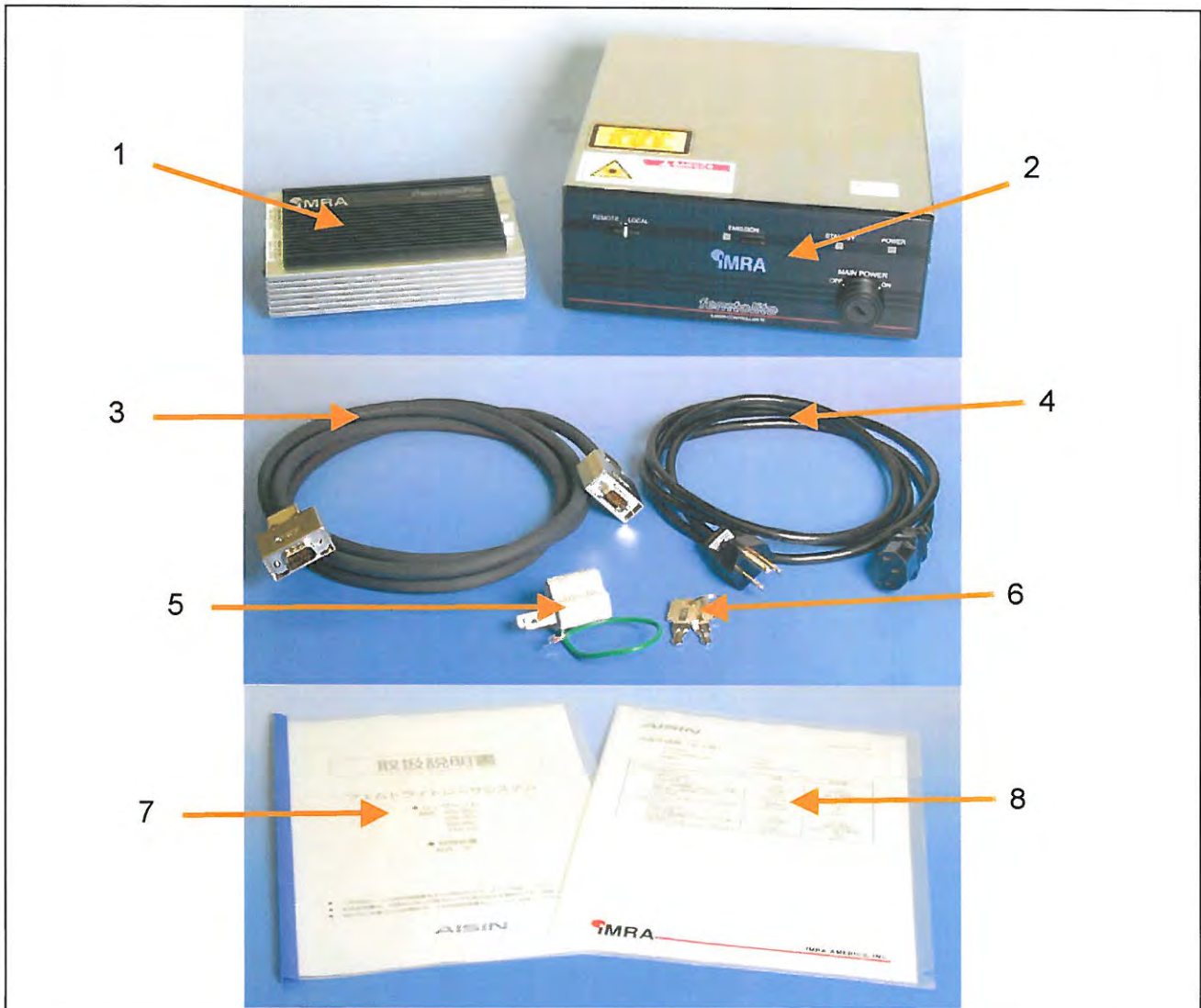
There is a risk of burns.



Before Use

Check the Package Contents

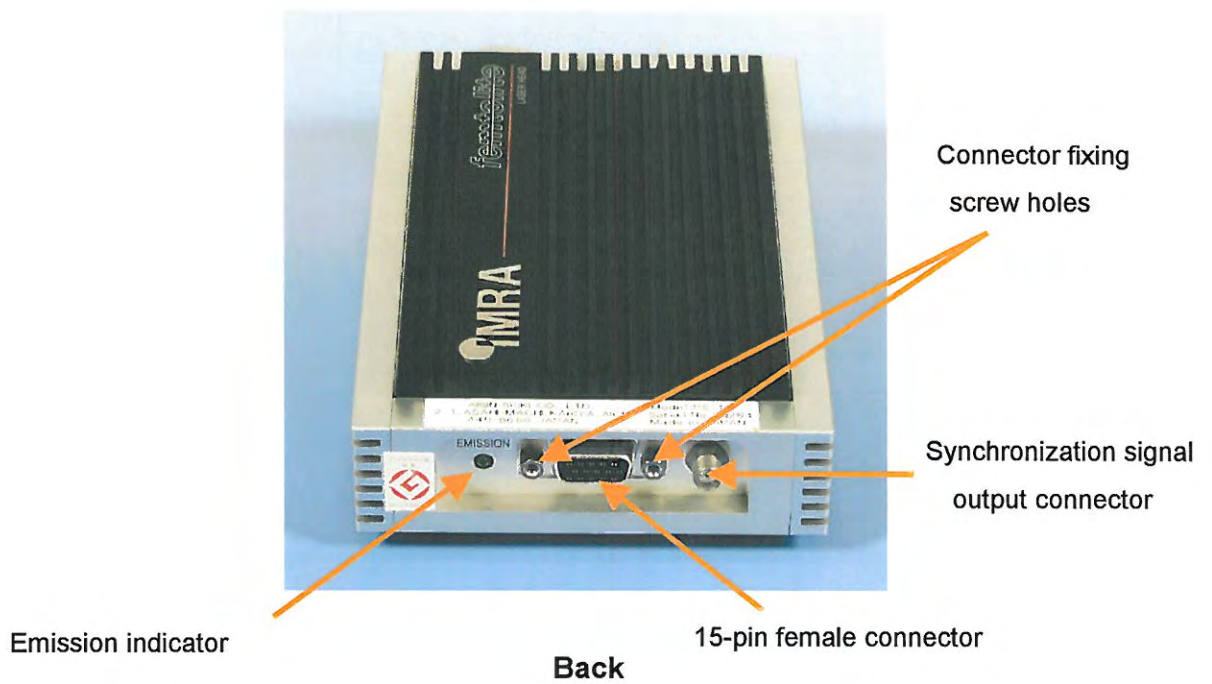
After opening the package containing the laser system, check that all the parts listed below are included. If any parts are missing or damaged, contact IMRA America, Inc. (See the back cover or page 32 of this manual for contact information)



Number	Name	Quantity	Number	Name	Quantity
1	Laser head	1	5	Power adapter plug	1
2	Controller	1	6	Power key	2
3	Connection cable	1	7	User's manual	1
4	AC cable	1	8	Product inspection certificate	1

Component Names

- Laser head



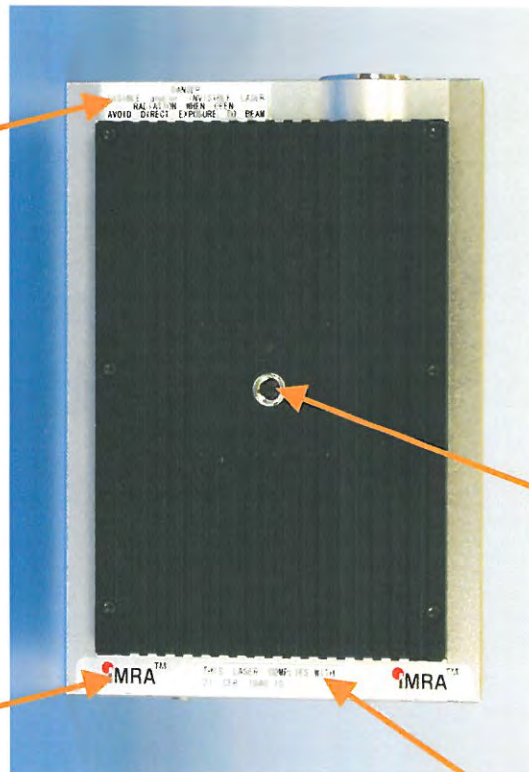
Laser head
warning label
(see page 10)

Security label

Laser head
mounting screw

Bottom

FDA certification
label



- Controller

Warning label
(see page 10)

Standby indicator

Power
indicator

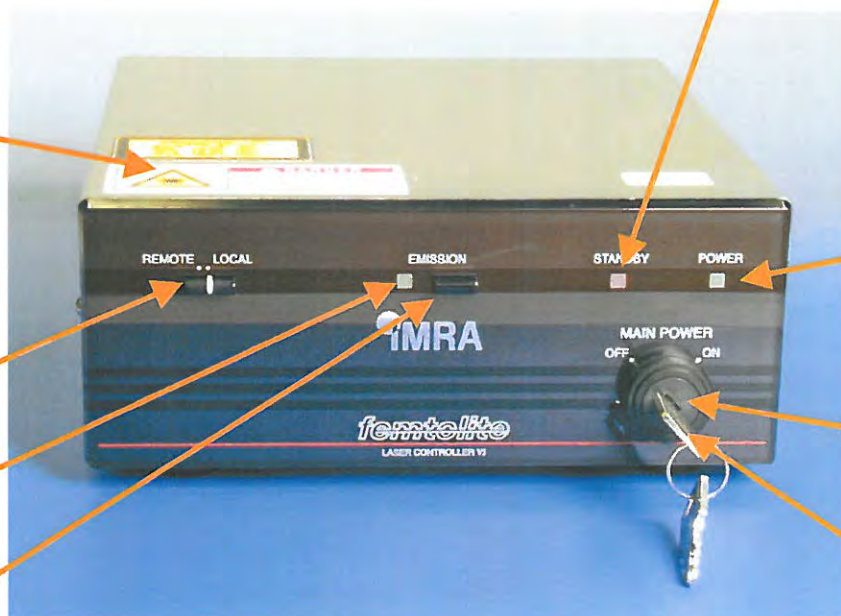
Remote /Local
selection switch

Emission indicator

MAIN POWER key
switch

Emission button

Power key



Front

Remote control
connector

Inlet

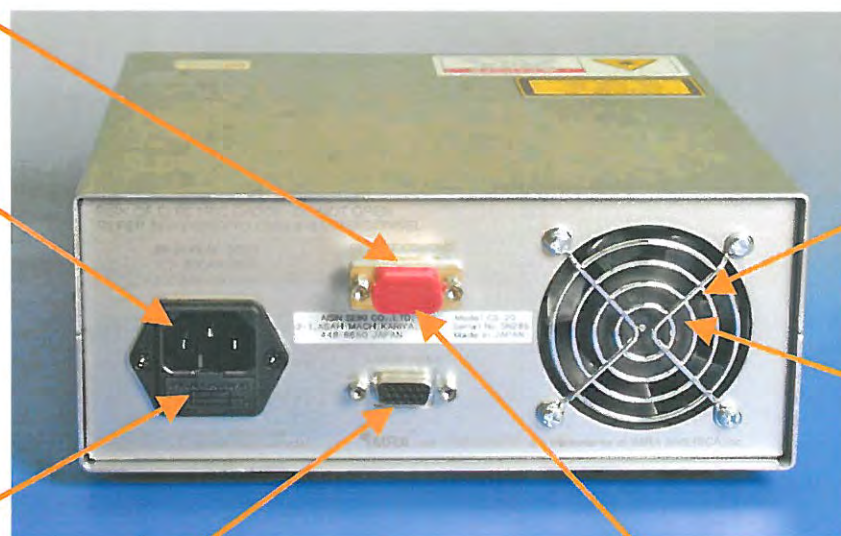
Fan guard

Fuse case

Laser head
connector

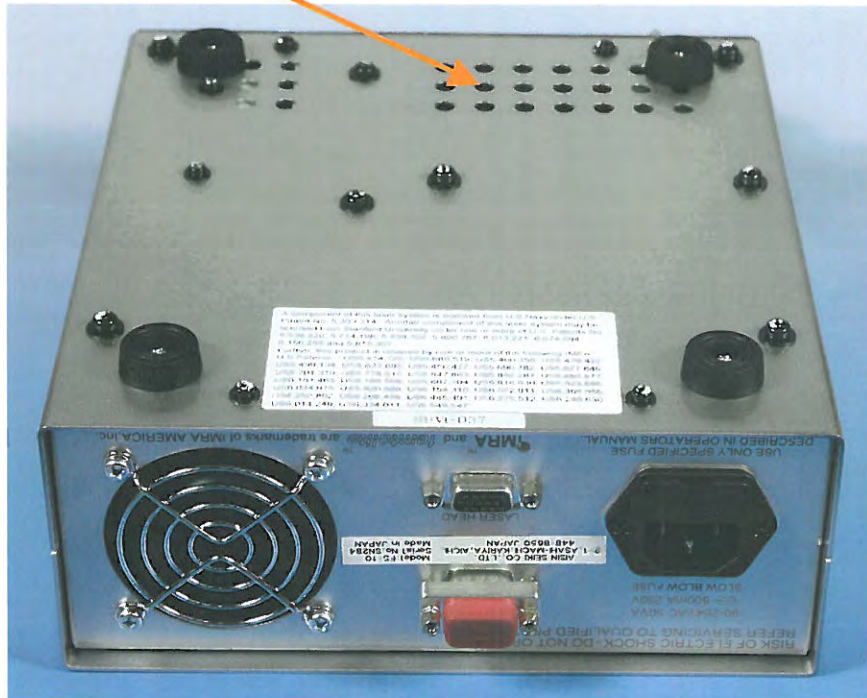
Fan

Interlock jumper



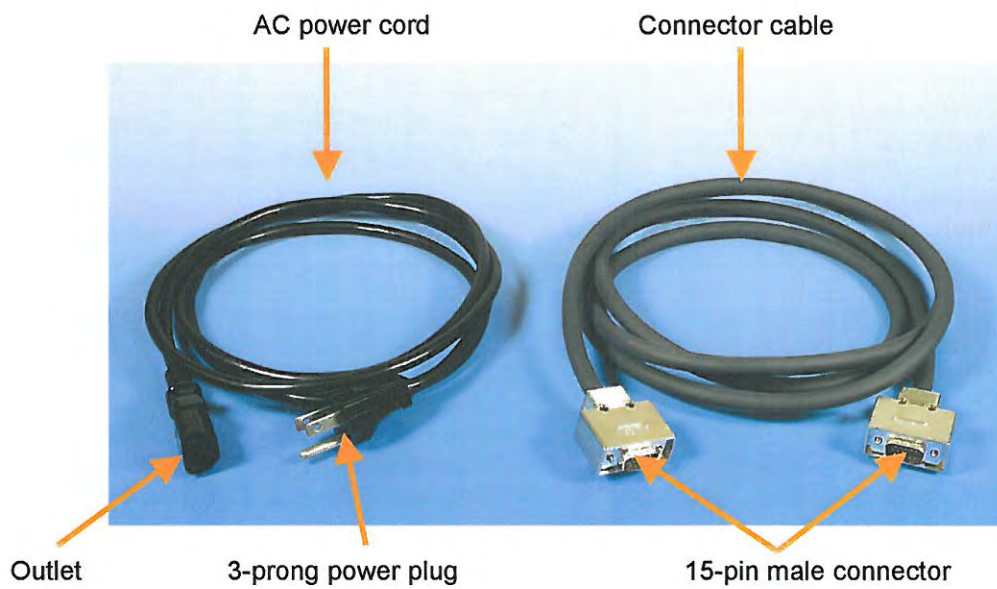
Back

Exhaust holes



Bottom

- Cables



- Warning labels

AX-20



AX-20

BX-60



BX-60

CX-20



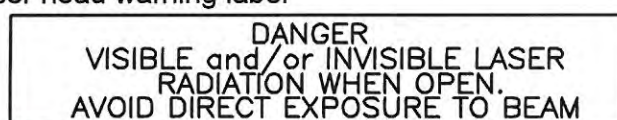
CX-20

FX-10



FX-10

- Laser head warning label



Labeling conforms to JIS C 6802 (IEC-61040) and FDA 21 CFR 1040.10.

Setting Up

- To set up the laser head, use a mount such as an optical post.
- Set up environment
 - Operating Environment Temperature 15C° to 35C°
 - Operating Environment Humidity Below 75%RH (No condensation)
 - Setup Environment

An environment free of materials that can attach to the optical system and cause a loss of output such as oil mist, fine particles, corrosive gas, or volatile siloxane produced by some types of silicone resin.
 - Installation Flatness $\pm 0.1\text{mm}/1\text{m}^2$ (equivalent to a commercial optical bench)
- Set up direction
 - You can mount the laser head either horizontally or vertically.



"Horizontally mounted"



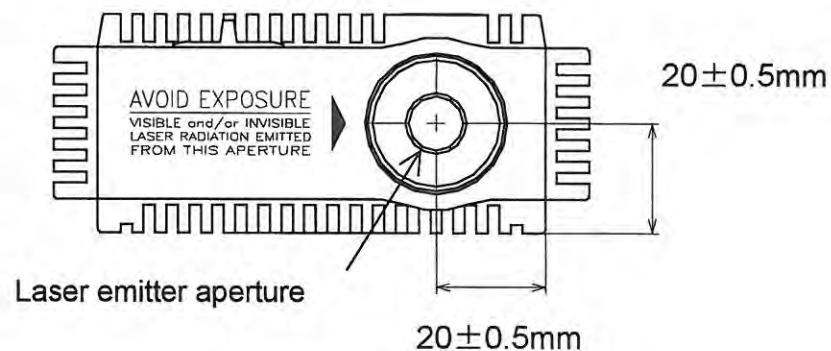
"Vertically mounted"

To setup, use the horizontal mount or vertical mount sold separately (see page 33), or use a commercial optical post. The threaded screw hole accepts an M6 screw.

<Reference> Emission direction of the beam

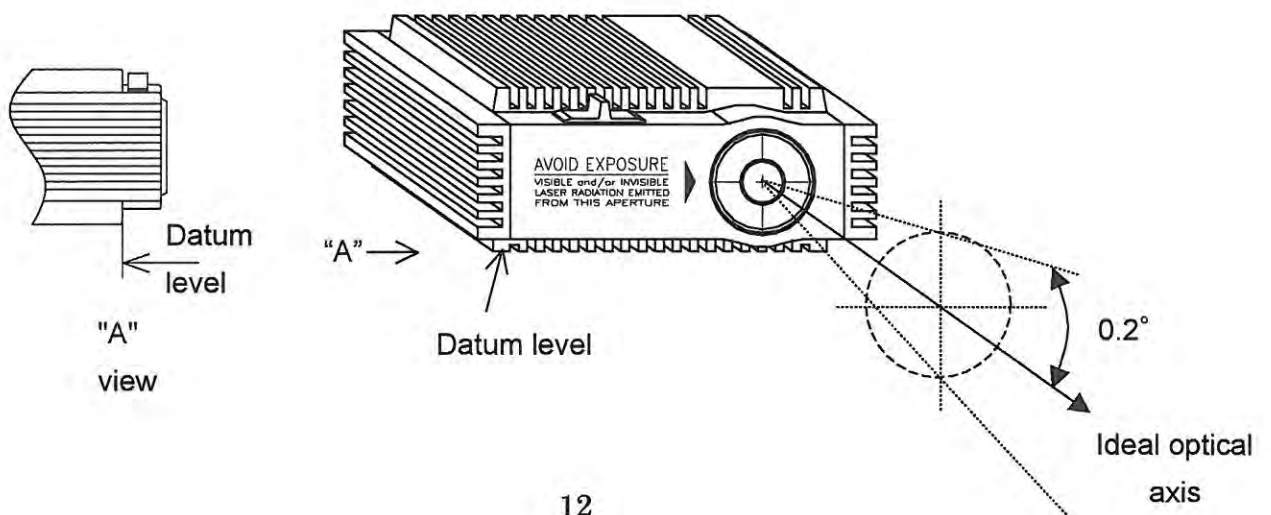
- Laser emission location

Beam emission height is $20 \pm 0.5\text{mm}$ and horizontal position is $20 \pm 0.5\text{mm}$ from the side of the laser head.



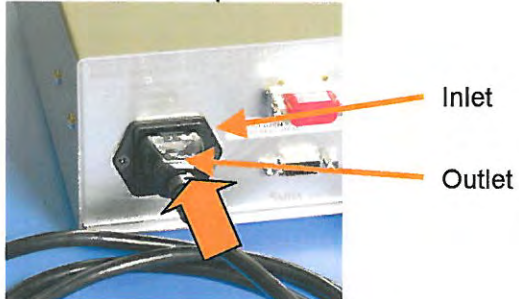
- Optical axis deflection angle of the beam

The beam is emitted at a deflection angle of within $\pm 0.2^\circ$ with respect to the ideal optical axis. The ideal optical axis is in the normal direction with respect to the datum level.



Connecting the Laser Head and Controller

1. Connect the AC power cord's outlet to the inlet on the controller.



2. Connect the laser head and controller with the connection cable.



3. Tighten the 15-pin male connectors with the connector fixing screws



Connector fixing screws

Important Points to Know

The delay time of laser emission after laser is ON

The laser beam is emitted about 7 seconds after the emission button is pressed to ON.

Caution after transporting the laser system

When transporting, the temperature of the laser system may drop below 15 degree C or rise above 35 degree C, therefore turn on the power after allowing the system to acclimatize for 5 or more hours in a room temperature between 15 and 35 degree C.

When using as a seed light generator for a regenerative amplifier

When using this laser system as a seed light generator for a regenerative amplifier or the like, insert an optical isolator with an isolation of over 60 dB to prevent optical damage to the wavelength-conversion-element of this laser system from amplified light.

Outputting an electronic pulse signal synchronized with the laser's repeat frequency

When an SMA coaxial cable is connected to the laser head's synchronization signal output connector, the system can output an electronic pulse signal that is synchronized with the laser's repetition frequency.

(See page 18 for how to output this signal.)

* The SMA coaxial cable is not supplied with this system. Please provide your own cable.

A temperature protection function

If the temperature of the laser head drops below 15 degree C or rises above 45 degree C, in order to prevent temperature related problems, the temperature protection function will be activated so that laser emission will stop automatically and the standby indicator will blink.

<To deactivate the temperature interlock>

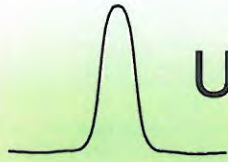
Adjust the ambient temperature where you are using the system so that the temperature of the laser head will be between 15 degree C and 45 degree C. When the temperature of the laser head is between 15 degree C and 45 degree C, the temperature interlock will be deactivated automatically, and the standby indicator will change from blinking to fully lit.

A remote control connector enabling remote control of the system

When you connect your circuit to the remote control connector on this system, you can remote-control the system to perform the following.

(See page 19 for more information.)

- Control of starting and stopping laser emission.
- Output of laser light emission and stop status indicator signal
- Remote Interlock



Using the Laser

Switching Laser Emission On

DANGER



Wear laser safety glasses
appropriate to the wavelengths
being used

There is a risk of eye damage and severe
loss of eyesight.

1. Close the shutter by moving the shutter lever to the CLOSE position.



2. Plug the 3-pin AC power cord into the AC power outlet.
3. Set the LOCAL/REMOTE to the LOCAL position.



4. Insert the power key and turn the MAIN POWER key switch clockwise to the ON position.
(Wait until the POWER indicator and STANDBY indicator illuminate)



5. Press the EMISSION button.

(The EMISSION indicator will light green, and after about 7 seconds laser light will be emitted.)



6. Open the shutter by moving the shutter lever to the OPEN position.

(Laser light will be emitted from the laser emitter aperture.)



Switching Laser Emission Off

1. Press the EMISSION button when the EMISSION indicator is lit.
(Laser output will stop, and the EMISSION indicator will go out.)



2. Turn the MAIN POWER key switch counterclockwise to the OFF position and remove the power key.
(The POWER and STANDBY indicators will go out.)



3. Close the shutter by moving the shutter lever to the CLOSE position.



Outputting an Electronic Signal Synchronized With the Laser's Output Pulses – Trigger Out

1. Connect the synchronization signal output connector (SMA, female) and a measuring instrument (such as an oscilloscope) with an SMA coaxial cable.



SMA coaxial cable

[Note]

- Use a measuring instrument (an oscilloscope, etc.) with a bandwidth of greater than 1 GHz. When using a measuring instrument with a bandwidth of less than 1 GHz, displayed peak values may be smaller than real peak values.
- No SMA coaxial cable is supplied with this system. Please provide your own cable.

2. Set the terminator on the measuring instrument to 50Ω .
3. Turn the measuring instrument on.
(The laser's repetition frequency will be displayed on the measuring instrument.)

Remote Operation

This system can be operated remotely by connecting your circuit to the remote control connector.

The following are operations that can be done by remote control.

- Control of starting and stopping laser emission
- Outputting the indicator signal for the laser emission and stop status
(Reading the controller's laser emission and stop status)
- Remote Interlock
(A function to stop laser emission with the highest priority regardless of the status of the control signal input)

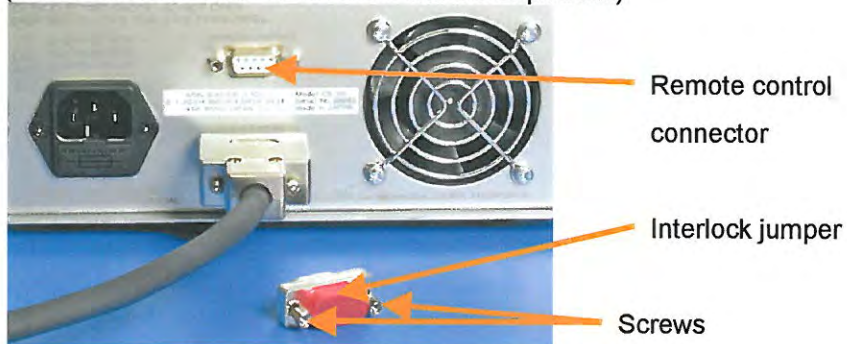
It is necessary for you to create your own circuit in advance when using remote control operation. Construct your circuit by following the instructions given in the next section, "Connecting to the Remote Control Connector."

Connecting to the Remote Control Connector

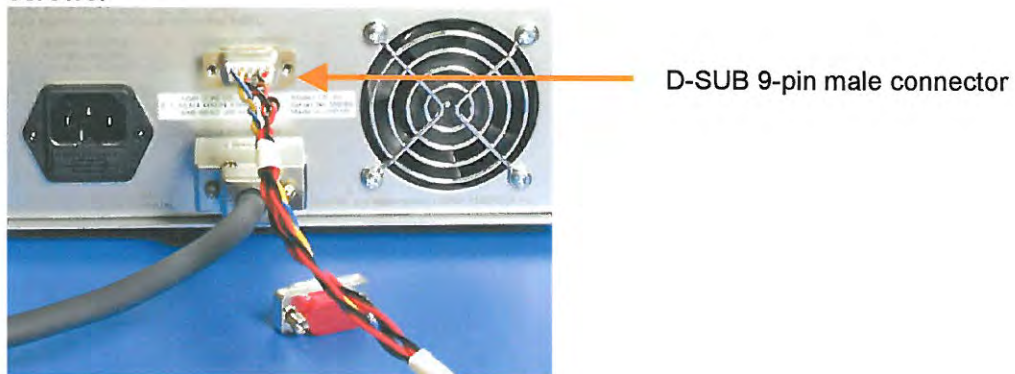
[Note]

- You will need a D-SUB 9-pin male connector and cable to control the system remotely. Neither D-SUB 9-pin male connector nor cable is supplied with this system. Please provide your own connector and cable.
 - Use a chatter-free signal such as TTL as a remote control signal. Using a relay contact signal with chatter will make the laser diode easier to break.
1. Create a control circuit (your circuit) corresponding to the function of the pins shown in Table 1 (see page 21).
 2. Turn the MAIN POWER key switch on the controller counterclockwise to the OFF position. (The POWER and STANDBY indicators will go out.)

3. Remove the interlock jumper by loosening the screws.
(The remote control connector will be exposed.)



4. Plug a D-SUB 9-pin male connector into the remote control connector and tighten with screws.



Remote Control Connector Pin Functions



Table 1

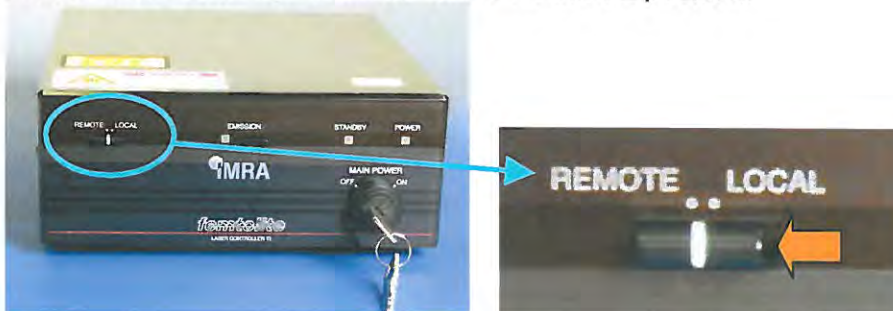
Pin No.	Signal Name	Usage Example	Function Explanation
1	Laser Start/ Stop		<p>Apply 5 V to pin 1 beforehand.</p> <p>1) When pin 2 signal voltage is "H"= 5 V, laser emission will stop.</p> <p>2) When pin 2 signal voltage is "L" = 0 V, laser emission will start.</p> <p>Use a chatter-free signal such as TTL. (Very important! Relay contact input is forbidden.)</p>
2			
3	Unused	Do not connect to this pin	
4	Remote Interlock		<p>1) The interlock function will stop laser emission with the highest priority, regardless of pin 1 and 2 signals, when the circuit between pins 4 and 5 is "Open."</p> <p>2) Interlock detection indicator When this function is operating, the EMISSION indicator will blink and it will maintain this state.</p> <p>3) Hold deactivation "Close" the circuit between 4 and 5, turn the MAIN POWER key switch counterclockwise to the OFF position, and the hold will be deactivated.</p>
5			
6	Unused	Do not connect to this pin	
7	Unused	Do not connect to this pin	
8	Laser Emission Status	<p>An example circuit that lights an LED during laser emission</p>	<p>The controller status will be transmitted to your circuit.</p> <p>1) The LED will be lit during laser emission.</p> <p>2) The LED will be unlit unless laser emission takes place.</p>
9			

Switching Laser Emission On and Off

- Apply 5 V to pin 1 beforehand.

- Switching on laser emission by remote control

1. Check that the MAIN POWER key switch is in the OFF position (turned counterclockwise).
2. Set the LOCAL/REMOTE switch to the REMOTE position.



3. Turn the controller's MAIN POWER key switch clockwise to the ON position.
(The POWER and STANDBY indicators will light)
4. Apply 0 V to pin 2.
(The EMISSION indicator will light, and laser emission will begin after about 7 seconds.)

- Stopping laser emission by remote control

1. Apply 5 V to pin 2.
(The EMISSION indicator will light, and the laser will stop.)
2. Turn the MAIN POWER key switch counterclockwise to the OFF position.
(The POWER and the STANDBY indicators will go out.)

- Converting from REMOTE to LOCAL operation.

1. Set the LOCAL/REMOTE switch to the LOCAL position.
2. Attach the interlock jumper to the remote control connector.



3. Tighten the interlock jumper screws.

Electrical Signal Output of the Status

As shown in Table 1 (page 21), you are able to show the controller status on your circuit by connecting an LED.

Supply 5 V of power and use a 330Ω resistor.

Interlock Operation

When the interlock is operating, laser emission will stop with the highest priority regardless of the presence of the laser start/stop signal.



Warning

Always reset your circuit before deactivating the interlock hold.



When deactivating (re-closing) the interlock circuit, laser emission will occur if the laser emission signal (pin 2: 0 V) is still active.

Always deactivate the laser circuit before re-closing the interlock circuit.

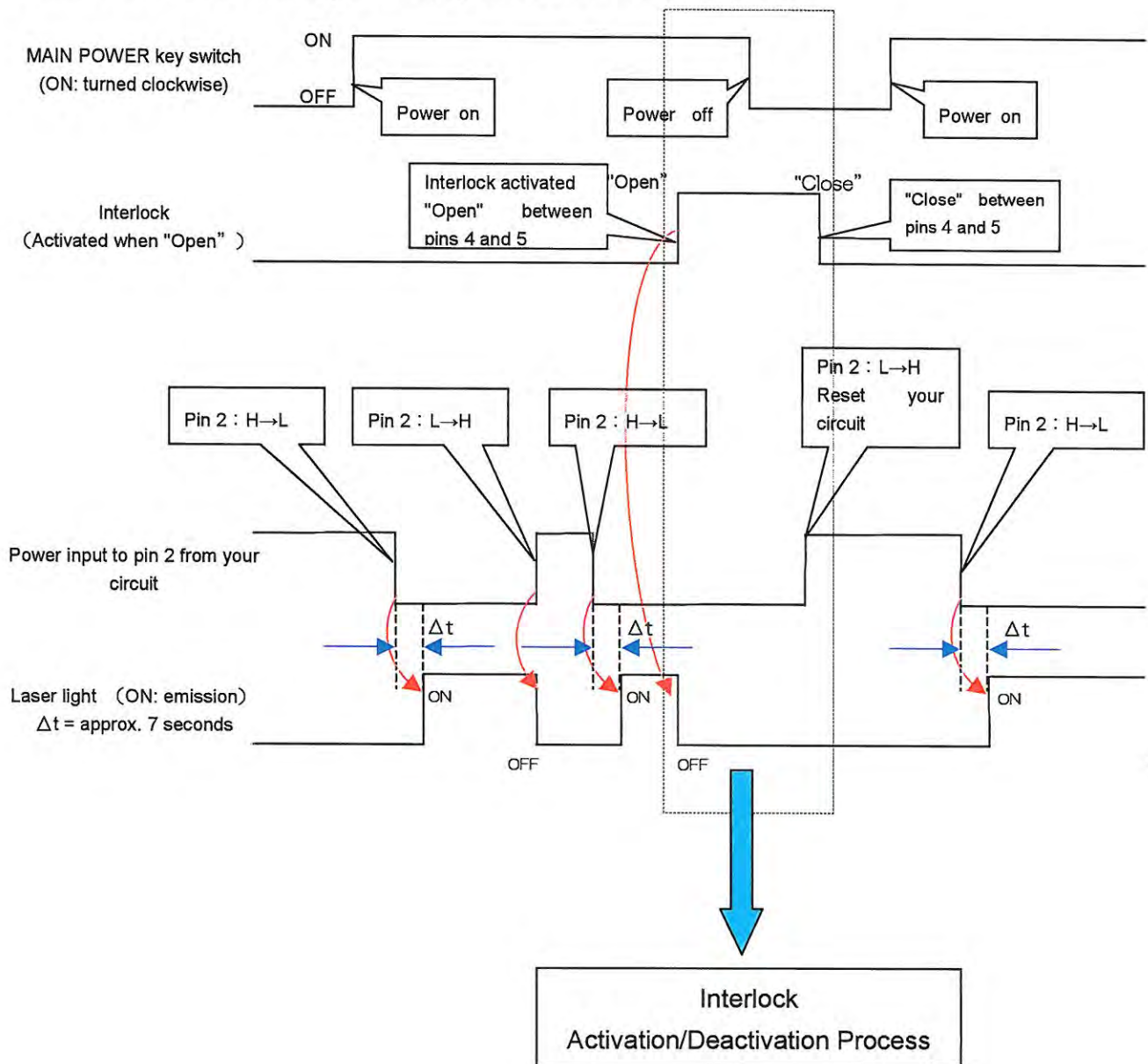
- Stopping the laser with the interlock

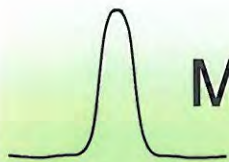
1. "Open" the circuit between pin 4 and 5.
(Laser emission will stop, and the EMISSION indicator will blink.)
2. Turn the MAIN POWER switch key counterclockwise to the OFF position.
(The POWER indicator STANDBY indicators will go out.)

- Deactivating the interlock

1. Reset your circuit.
(Input to pin 2 will be 5 V.)
2. "Close" the circuit between pins 4 and 5.
(The interlock will be deactivated.)
3. Turn the MAIN POWER switch key clockwise to the ON position.
(The POWER and STANDBY indicators will light.)

<Reference> An example timing chart for remote control





Maintenance and Storage

Normal Maintenance

Warning



Turn the power off,
Remove the power key
There is a risk of electric
shock.

Wipe debris from the laser head and controller with a soft cloth.

(When you cannot remove the debris with a dry cloth, lightly remove it with a soft cloth soaked in a neutral detergent)

[Note]

- Do not use organic solvents such as benzine or thinner, nor use bleaching agents as they can cause color change and corrosion.

Changing the Fuse

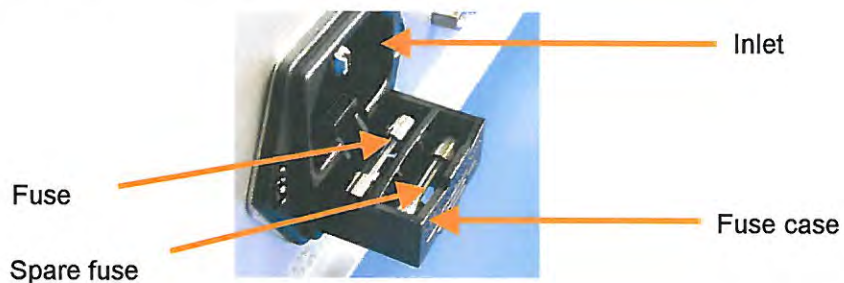
Warning



Unplug the 3-prong
power plug from the
outlet
There is a risk of electric
shock.

1. Turn the MAIN POWER key switch on the controller counterclockwise to the OFF position.
(The POWER and STANDBY indicators will go out.)
2. Unplug the 3-prong power plug from the outlet.

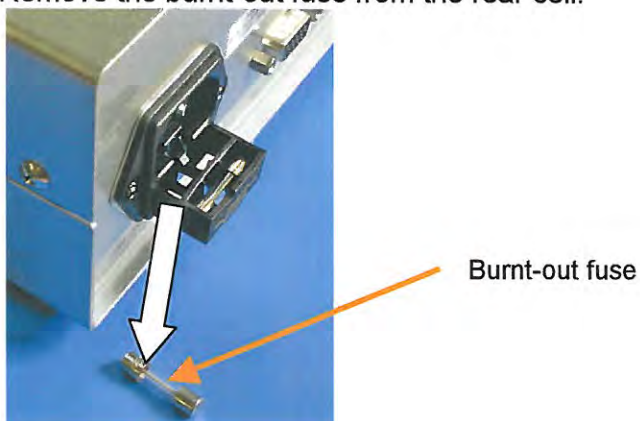
3. Pull open the fuse case under the inlet.



[Note]

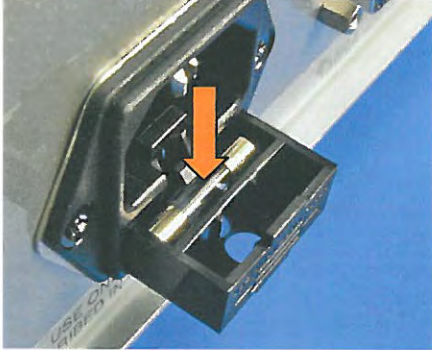
- Use the specified fuse (see page 33).
- If the fuse burns out right after being changed, contact IMRA America Inc. Contact information is printed on the back cover and page 32 of this manual.

4. Remove the burnt-out fuse from the rear cell.

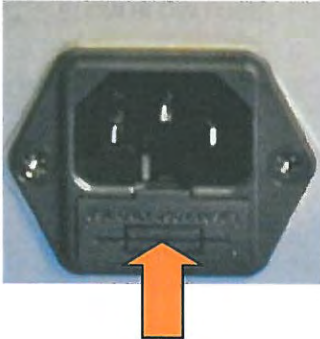


5. Remove the spare fuse from the front cell.

6. Set the spare fuse in place.



7. Push in the fuse case until you hear a click.



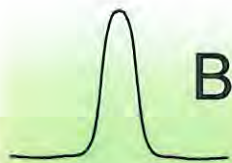
Storage

- When you will not use the Femtolite Laser System for an extended period of time, store it in a location with the following characteristics.

- Extended Storage Environment Temperature	10°C to 45°C
- Preferred Extended Storage Humidity	Below 50%RH

[Note]

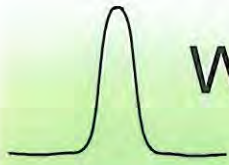
- Do not store near devices that generate strong electric or magnetic fields.
- Do not store in a place where there is a risk of static discharge.



Before Requesting Repair Service

- Check the following items before requesting repair service. If you are unable to solve your problem after checking these items, contact IMRA America, Inc. Contact information is given on page 32.

Problem	Cause	Solution
Laser emission does not occur. (POWER indicator lit) (STANDBY indicator lit) (EMISSION indicator lit)	The shutter lever is set to the CLOSE position.	Set the shutter lever to the OPEN position. (See page 16.)
Laser emission does not occur. (POWER indicator lit) (STANDBY indicator lit) (EMISSION indicator unlit)	The LOCAL/REMOTE switch is set to the REMOTE position.	Set the LOCAL/REMOTE switch to the LOCAL position. (See page 15.)
Laser emission does not occur. (POWER indicator lit) (STANDBY indicator lit) (EMISSION indicator blinking)	The interlock jumper is not connected.	Push the interlock jumper completely in and turn the power on again. (See page 23.)
Laser emission does not occur. (POWER indicator lit) (STANDBY indicator blinking) (EMISSION indicator unlit)	The temperature interlock is operating.	Bring the laser head temperature to between 15 °C and 45 °C and push the EMISSION switch again. (See page 14.)
	The connection cable is not connected.	Plug the connection cable completely in. (See page 13.)
Laser emission does not occur. (POWER indicator lit) (STANDBY indicator blinking) (EMISSION indicator blinking)	The connection cable and interlock jumper are not connected.	Connect the connection cable and the interlock jumper. (See pages 13 and 23.)
Laser emission does not occur. (POWER indicator unlit) (STANDBY indicator unlit) (EMISSION indicator unlit)	The AC power cord is not plugged in.	Plug the AC power cord completely into the AC power outlet and controller inlet. (See pages 13 and 15.)
	The fuse is burnt out.	Change the fuse. (See page 26.)
Decreased laser output (POWER indicator lit) (STANDBY indicator lit) (EMISSION indicator lit)	The shutter lever has not been moved completely to the OPEN position.	Move the shutter lever bar completely to the OPEN position. (See page 16.)



Warranty and Repair Service

About the Warranty

- Warranty period

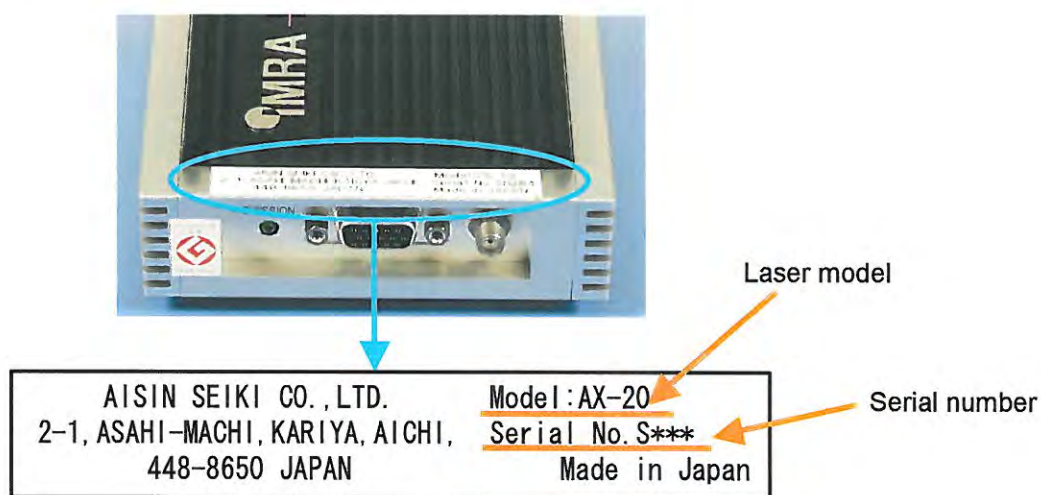
The warranty period is 1 year from the shipping date.

- Warranty provisions

- The warranty period for this product is 1 year from the shipping date.
During the warranty period, if the product malfunctions in spite of normal use while following the instructions and precautions given in this user's manual and on the product labeling, then the product will be repaired free of charge as provided by the warranty.
- The following conditions will result in a repair charge even if they occur during the warranty period.
 - Malfunction or damage that results from fire, earthquake, flood damage, lightning, or other acts of nature
 - Malfunction or damage that results from use that violates the instructions and precautions given in the user's manual, including excessive optical feedback
 - Malfunction or damage that results from the use of the product in an environment with concentrations of floating materials that can attach to the optical system such as corrosive gas, oil mist, fine particulate matter, or volatile methyl siloxane produced by some types of silicone resins; or using the product in an environment that exceed specifications, such as one that is subject to high temperatures, high humidity, extreme low temperatures, vibrations, or shocks.
 - Removal of security label voids warranty
- Replacement parts will be held in stock for a period of 7 years after the end of production.

Repair Service

- The product must be sent to AISIN SEIKI Co., Ltd. for repair service.
- Before sending your product for repair, notify IMRA America, Inc., at the location below with the laser model and serial number.



- If a shipping box is necessary, notify IMRA America, Inc., at the location below before sending the product for service.

Repair Service Contact Information

Marketing and Sales Department, IMRA America, Inc.

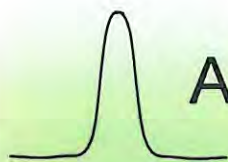
1044 Woodridge Ave., Ann Arbor, MI 48105

Phone : (734) 930-2560

E-mail : lasers@imra.com

Business Days : Weekdays (Mon. through Fri.)

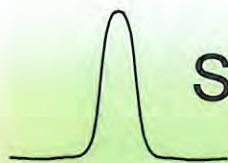
Business Hours : 8:00 to 17:00 US Eastern Time Zone



Accessory Information

- We provide many convenient accessories for use with our laser system. To order, contact IMRA America, Inc. at the contact information given on the back cover of this manual.

Accessory Name	Part Number	Specification
Slow blow fuse	FL700-B0081	Littelfuse 5x20 mm 239 series, part: 239.800
Connection cable	FL600-E2229	2 m
	FL600-E2306	5 m
AC power cord	FL700-B0072	2 m
Power Key	FL600-E2231	1 set (2 keys)
Power Adapter Plug	FL600-B0044	Can convert 3-prong AC power cord to 2-prong. HOZAN 3-prong Adapter HS-32
Transportation Container	FL600-E2288	
Horizontal Mount Set		
	FL800-9000	A mount to set up the laser head in the horizontal position. Three heights of mounting posts (50, 70, 100 mm) are included to bring the laser emitter aperture to the necessary height.
Vertical Mount Set		
	FL800-9100	A mount to set up the laser head in the vertical position.



Specifications

Femtolite ULTRA Laser System

Model			AX-20	BX-60	CX-20	FX-10
Laser head	Second-harmonic output	Center wavelength (nm)	780 band ⁽¹⁾		780 band ⁽¹⁾	800± 7
		Average power (mW)	>20		>20	>10
		Pulse width ⁽²⁾ (fsec)	<100		<100	<120
		Spectral width (nm)	>7		>7	>7
		Output coupling ⁽³⁾	Free space TEM00 vertical polarization		Free space TEM00 vertical polarization	Free space TEM00 vertical polarization
		Beam diameter (mm) ⁽⁴⁾	2.5±0.5		2.5±0.5	2.5±0.5
	Fundamental output	Center wavelength (nm)		1560 band ⁽¹⁾		
		Average power (mW)		>60	>20	
		Pulse width (fsec)		<100		
		Spectral width (nm)		>25		
		Output coupling ⁽³⁾		Free space TEM00 vertical polarization		
		Beam diameter (mm) ⁽²⁾		1.5±1.0	4.0±1.0	
	Repetition rate (MHz)		50±2			
	Synchronization signal output voltage (mV)		>20			
	Synchronization signal output rise time (ns)		< 1			
	Synchronization signal output bandwidth (GHz)		0.5			
	Beam emission location (mm)		20±0.5 from the bottom of the laser head、20±0.5 from the side			
	Beam optical axis reflection angle (°)		±0.2 off of the ideal optical axis			
	Size (mm)		145 (235 when connected) × 98 × 40			
	Weight (g)		approx. 800			
	Operating environment temperature (°C) , Humidity (%)		15-35、<75% RH (no condensation)			
Controller	Switches	1) Power key switch	Key switch (clockwise turn: OFF, counterclockwise turn: ON)			
		2) Emission button	Push ON button			
		3) Local/Remote switch	Slide switch			
	Connectors		Laser head connector: High density 15-pin female connector			
			Remote control connector: D-SUB 9-pin female connector			
AC Inlet (3-prong, grounded)						

Model		AX-20	BX-60	CX-20	FX-10
Controller	Operation confirmation lights		Power indicator (Green LED)		
			Standby indicator (Orange LED)		
			Emission indicator (Green LED)		
	LD current safety system		Constant current control + TEC controller system		
	Safety features	External current leakage (mA)	< 1		
		Heat protection	120 °C temperature fuse included		
		Fuse capacity	800mA slow blow fuse		
	Remote control (D-SUB 9-pin female connector)	Laser start/stop Input signals	"H" =5 V, "L" =0 V With "H" applied to pin 1, Stop the laser by applying "H" to pin 2 Start the laser by applying "L" to pin 2 Use a chatter-free signal such as TTL (Very Important!)		
		Interlock	Stop laser emission with highest priority To activate interlock, open the circuit between pins 4 and 5 To deactivate the interlock, short-circuit pins 4 and 5 and turn <u>on</u> the power with the key switch		
		Status indicators	A signal to display the laser emission status is produced on pins 8 and 9 $I_e = 10 \text{ mA (MAX)}$, $V_{CE} = 24 \text{ V (MAX)}$		
	Operating environment temperature (°C) , Humidity (%)		0-40, <75% RH (no condensation)		
	Size (mm)		200 × 215 (315 when connected) × 89		
	Weight (kg)		approx. 2.0		
	Power consumption (VA)		50		
	Input current		AC 90-264V, 50/60Hz		
	Attaching the controller		As detailed in the controller model VI setup specifications (Available separately; consult IMRA America Inc.)		
Others	AC power cord length (m)		2 ± 0.1		
	Connection cable length (m)		2 ± 0.1		

- (1) The central value of the spectrum is the sharp peak near the center.
- (2) Assuming hyperbolic-secant-squared pulse shape.
- (3) When laser head is mounted horizontally.
- (4) Diameter of the beam at a location of 50 cm from the laser emitter aperture.

If you have any questions or are unclear about the setup, use, or management of this laser system, please contact IMRA America, Inc.



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Manufacturer

AISIN
AISIN SEIKI CO., LTD.

SP21/05/HO/V02/E



Model: AX-20
S/N: S281
PO#: 0117239
Case#: 1 of 1
Made in Japan



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